(12) UK Patent Application (19) GB (11) 2 366 900 (13) A

(43) Date of A Publication 20.03.2002

(21) Application No 0022461.8

(22) Date of Filing 13.09.2000

(71) Applicant(s)
box consultants Ltd
(Incorporated in the United Kingdom)
1-3 Leonard Street, LONDON, EC2A 4AQ,
United Kingdom

Marcus Taylor
55 Laburnam Street, LONDON, E2 8BD,
United Kingdom

(72) Inventor(s)
Tom Barker
Marcus Taylor

(74) Agent and/or Address for Service
Boult Wade Tennant
Verulam Gardens, 70 Gray's Inn Road, LONDON,
WC1X 8BT, United Kingdom

(51) INT CL[7]
G09F 9/33

(52) UK CL (Edition T)
G5C CA361 CA363 CHC

(56) Documents Cited

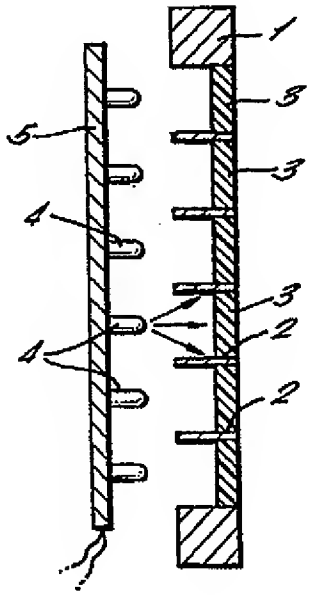
GB 2131589 A	EP 0210274 A
EP 0206176 A	EP 0182254 A
US 4485377 A	US 3810168 A

(58) Field of Search
UK CL (Edition S) G5C CHC CHD CHG
INT CL[7] G09F 9/00 9/30 9/33

(54) Abstract Title
An Illuminated Display Element

(57) The present invention relates to a display element and a method of manufacturing the element. The element is arranged to emit light from an array of light sources and can be used as a low resolution screen as part of a wall, ceiling or walkway. The display element comprises a block of support material 1 into which an array of through-holes 2 have been cut. The support material 1 is placed into a bath of resin which partially fills each through-hole 2. The resin sets to form a transparent or translucent window 3 in each through-hole 2. An array of light sources 4 may be mounted on a board 5 and attached to the support material 1 to emit light through the windows 3.

FIG. 1



GB 2 366 900 A

FIG. 1.

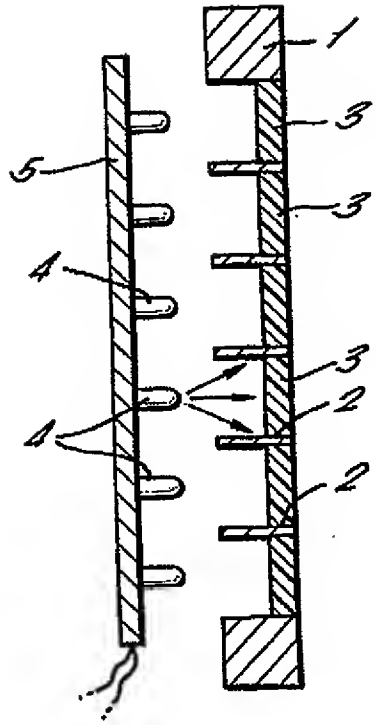


FIG. 2.

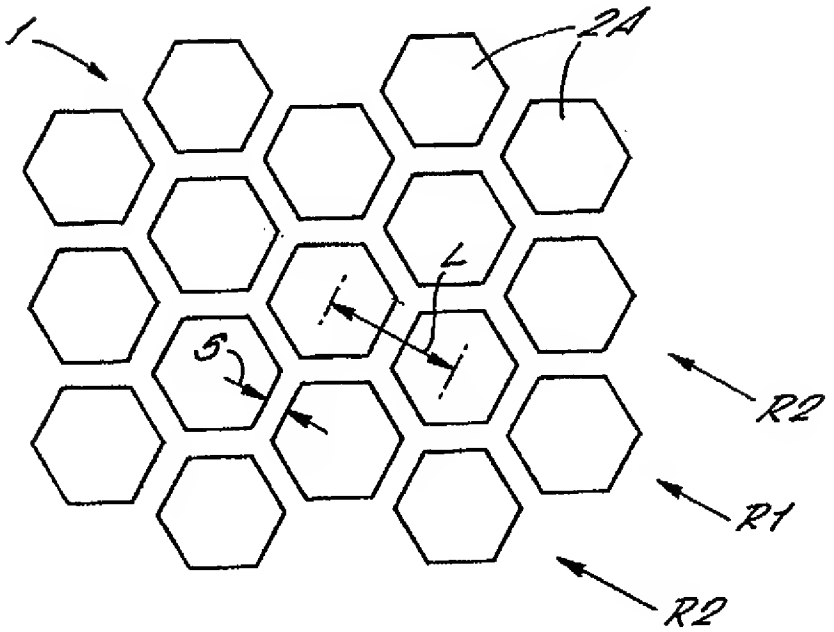


FIG. 3.

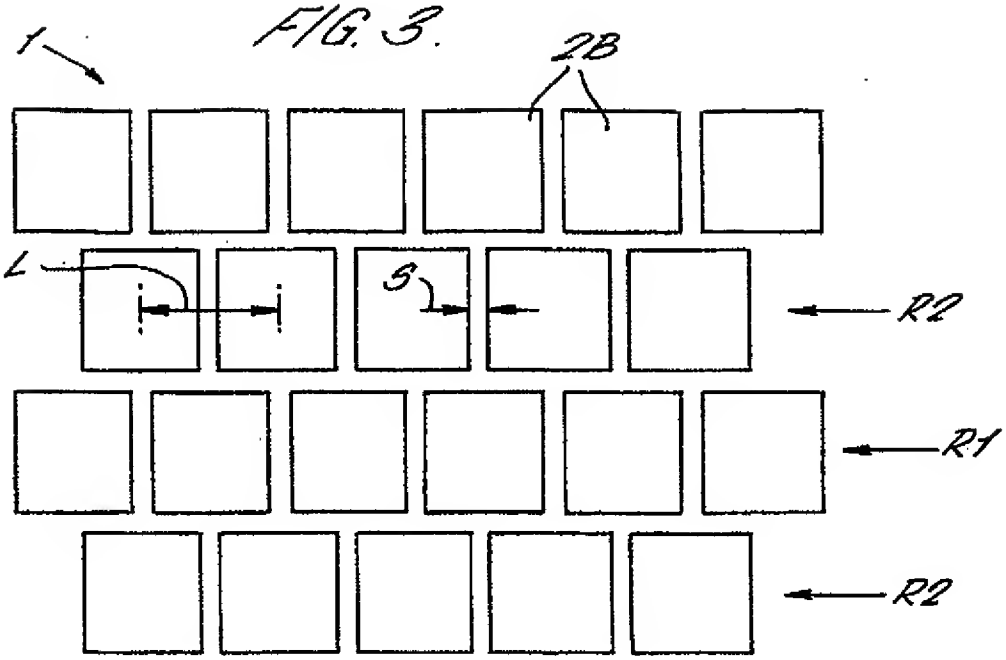
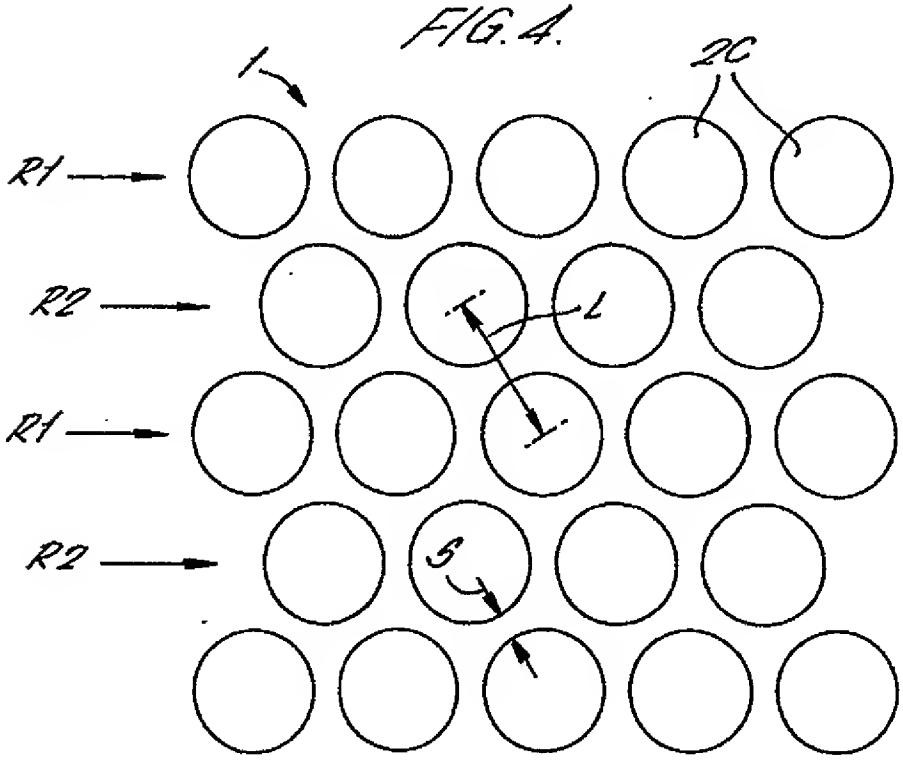


FIG. 4.



A DISPLAY ELEMENT

The present invention relates to a display element and also to a method of manufacturing the display element.

The display element is arranged to emit light from an array of light sources and is particularly suitable as a low resolution screen, and maybe used for example, in walls or ceilings, or as a walkway.

The present invention provides a method of manufacturing a display element, the method comprising the steps of forming a plurality of through holes in a support material; placing the support material in a bath of settable liquid so that the settable liquid partially fills each through hole; and setting the settable liquid to form a transparent or translucent window in each through hole.

Light is intended to be shone through the windows so produced. This technique allows large display elements to be mass-produced at very low cost. The windows that are produced are not of good optical quality as compared to many displays. Nevertheless, the displays can be used to provide the effect of relatively high resolution when viewed from distances of several tens of metres.

Preferably, the method further comprises the step of mounting a discrete light source in each through hole in a position to emit light through the window.

Preferably, the display element is capable of resisting external loads due to, for example, one or more people walking on the display element in the case

where the display element is a floor or walkway. In applications where the display element is used in the open, the display element would have a weather proof construction. For example, it would be made from materials which do not degrade substantially when exposed to external climates, and would also have a construction which limits the ingress of water.

The preferred material for the support material is a metal such as aluminum or aluminum alloy. The preferred settable liquid is a resin, and the preferred light source is an LED.

The through holes may be formed by a number of known methods. For example, the support material may be cast with the through holes already formed, or the through holes may be cut out by a technique such as EDM. Preferably, however, the through holes are formed by a high pressure water jet containing abrasive particles. This is particularly suitable for forming through holes in relatively thick slabs of support material. Also, this technique is readily suited to mass-production.

When the support is placed in the bath, its lower surface will inevitably be covered with resin. This layer of resin may be left in place, or may be removed. In particular, the method may comprise the additional step of polishing the face of the support material on the side containing the windows after the setting step. This will remove any unwanted resin from the face of the support, and also improves the optical quality of the windows.

The present invention also extends to a display element comprising a support material in which an array of through holes are formed, the through holes

being arranged so that one row in the array is shifted with respect to an adjacent row while the array maintains a closed packed configuration (i.e. in a close packed offset grid), the average spacing between adjacent centres of the through holes being greater than 10mm; a transparent or translucent material partially filling each through hole to form a window; and comprising a discrete light source in each through hole positioned to emit light through the window.

This creates a low resolution display in which, although the through holes are in a closed packed configuration, the offset between each row may be used to create more interesting visual effects than can be provided in a regular array when light is shone through the array of windows. In the case of a hexagonal and staggered square/rectangle arrangement, the pattern enhances the effective resolution of displayed image. Further, the use of the through holes which are partially filled with transparent or translucent material allows for large display elements to be mass-produced at little cost.

It should be noted that although the display element is particularly suitable for low resolution applications, it can be used as a high resolution screen suitable for static light images or dynamic video images and can be used for small or large displays of images.

There may be more than one set of through holes provided, each set having a different cross-section allowing a closed packed configuration to be formed. However, it is preferable for each through hole to have the same cross-section, the cross-section being a polygon such as a square or hexagon which can be arranged in a closed packed configuration. The cross-

section of each through hole may also be circular.

The support material may be any material which provides the necessary strength. However, the current preference is to use a metal and, more particularly, the preference is to use aluminum or aluminum alloy as this provides the necessary strength, whilst still being light enough to use in applications such as ceilings.

The transparent or translucent material may be any suitable material. However, the current preference is to use a resin. This can be introduced into a through hole in liquid form and set in this position allowing a large number of windows to be simultaneously formed.

The size of the holes would be determined by a number of factors including the size of the discrete light source used, and the intensity provided by the discrete light source. The size of the holes would generally be greater than 10mm, and typically be 25mm.

The average space in between adjacent centres of the through holes is preferably at least 15mm and is more preferably at least 20mm. The spacing should also be less than 100mm, more preferably less than 50mm and most preferably less than 30mm. The exact average spacing between adjacent through holes will be dependent upon the required use of display element. However, a spacing of between 20mm and 30mm is most preferable as it is the optimum size which can be well illuminated by a small controllable light source. This consideration is also important to the average spacing between adjacent elements. This is preferably between 1mm and 10mm, and is more preferably between 4mm and 6mm.

The most suitable light source is an LED and this provides an efficient light source which can readily be fitted into the limited space provided in the through hole, or a short distance behind the hole to allow the window to be evenly or flood illuminated (see Figure 1). Such discrete light sources display a single colour of light at a particular intensity at any one time. Each through hole may contain a single one colour LED, or may contain several different colour LEDs. The current preference is to use a multicolour RGB LED which is typically four different LEDs packaged in a single covering lens. This offers an optimum variety of different colours, whilst still allowing each different colour to be emitted from a relatively central location within the through hole.

The display element may be designed to emit a fixed image. However, preferably, a control system is provided which is capable of switching each light source on and off, and also varying the colour and intensity of each light source with respect to time. This provides a great deal of flexibility and allows for the creation of a wide range of visual effects.

Examples of display elements constructed in accordance with the present invention will now be described with reference to the accompanying drawings, in which:

FIG 1 is a cross-section showing the structure of the element;

FIG 2 is a diagramatic representation of a first arrangement of through holes;

FIG 3 is a diagramatic representation of a second arrangement of through holes; and

FIG 4 is a diagramatic arrangement of a third arrangement of through holes.

As shown in FIG 1 the display element comprises a block of support material 1 such as aluminum or aluminum alloy. Into this block, an array of through holes 2 have been cut using a water jet cutting technique as is well known in the art. The support material 1 in which the through holes 2 have been cut is then placed with its front face downwardly into a bath of resin such as epoxy, polyester, or phenolic resin, in liquid form. The resin is then allowed to set and the support material 1 is broken out of the resin bath with the resin having set to form windows 3 at the front of each through hole 2. A corresponding array of multicolour RGB LEDs 4 mounted on board 5 are then releasably attached to the support material 1. Each LED 4 is positioned to emit light through a respective window 3, and evenly or flood illuminate each window.

When the supporting material is metallic, the cut surfaces on the inside of the holes will reflect light over the lens, improving the distribution of light over the lens. This effect can be helped by adjusting the height that the LED is positioned at, and the depth of the hole. The lens clarity may be varied during manufacture to assist with the diffusion of light over the lens.

Different arrangements of through holes 2 are shown in FIGS 2-4. FIG 2 shows a closed packed arrangement of regular hexagonal through holes 2A formed in a honeycomb configuration. In this case, a first row R1 of through holes are offset with respect to each adjacent row R2 by an amount equal to half of the distance between centres of the through holes in each row.

FIG 3 shows an array of square through holes 2B

in which a first row R1 is again offset, by an amount equal to half the distance between centres of adjacent through holes in each row, with respect to the adjacent rows R2.

FIG 4 shows an array of circular holes 2C in which a first row R1 is also offset, by an amount equal to half the distance between centres of adjacent through holes in each row, with respect to the adjacent rows R2.

The average distance L between centres of adjacent through holes in a particular row is typically 25mm, while the separation S between adjacent through holes in a particular row is generally 5mm.

CLAIMS

1. A method of manufacturing a display element, the method comprising the steps of forming a plurality of through holes in a support material; placing the support material in a bath of settable liquid so that the settable liquid partially fills each through hole; and setting the settable liquid to form a transparent or translucent window in each through hole.

2. A method according to claim 1, further comprising the step of mounting a controllable or variable light source to emit light through the window and build up static or moving images.

3. A method according to claim 1 or claim 2, wherein the step of forming the through holes is carried out by a high pressure water jet containing abrasive particles.

4. A method according to claim any of the preceding claims, further comprising the additional step of polishing the face of the support material on the side containing the windows after the setting step.

5. A display element comprising a support material in which an array of through holes are formed, the through holes being arranged on a close packed offset grid, the average spacing between adjacent centres of the through holes being greater than 10mm; a transparent or translucent material partially filling each through hole to form a window; and comprising a discrete light source in each through hole positioned to emit light through the window.

6. An element according to claim 5, wherein each through hole has the same cross-section.

7. An element according to claim 5 or 6, wherein the support material is a metal.

8. An element according to any one of claims 5 to 7, wherein the metal is aluminium or aluminium alloy.

9. An element according to any one of claim 5 to 8, wherein the transparent or translucent material is a resin.

10. An element according to any one of claim 5 to 9, wherein the average space between adjacent centres of the through holes is at least 15mm and preferably at least 20mm and is less than a 100mm, preferably less than 50mm and more preferably less than 30mm.

11. An element according to any one of claim 5 to 10, wherein the average spacing between adjacent elements is between 1mm and 10mm and is preferably between 4mm and 6mm.

12. An element according to any one of claim 5 to 11, wherein the light source is an LED.

13. An element according to claim 12, wherein the light source is a multicolour RGB LED.

14. An element according to any one of claim 5 to 13, further comprising a control system capable of switching each light source on and off and also varying the colour and intensity of each light source.

17. A display element substantially as described with reference to the accompanying drawings.

18. A method substantially as described with reference to the accompanying drawings.